

Amendments to the Claims

This listing of Claims will replace all prior versions, and listings, of Claims in the application.

Listing of Claims:

1-22. (Canceled)

23. (New) A module for calculating the luminance value from an input image data, said input image data comprising a red (R) digital data value, a green (G) digital data value and a blue (B) digital data value, said module comprising:

a red left shift-by-one module, said red left shift-by-one module shifting said R digital data value to the left by one digital place value, producing a R intermediate digital data value;

a green left shift-by-two module, said green left shift-by-two module shifting said G digital data value to the left by two digital place values, producing a G intermediate digital data value;

a first adder, adding said R intermediate digital data value to said B digital value, producing a first intermediate value;

a second adder, adding G digital value to said G intermediate digital data value, producing a second intermediate value;

a third adder, adding said first intermediate value to said second intermediate value, producing a third intermediate value; and

a right shift-by-three module, said right shift-by-three module shifting said third intermediate value by three digital place values, producing said luminance value.

24. (New) The module for calculating said luminance value of Claim 23 wherein said module substantially performs the calculation $Y = (2 \cdot R + 5 \cdot G + B) / 8$, where Y is substantially the luminance value for said input image data.

25. (New) A module for calculating the hue angle of an input image data, said input image data comprising a red (R) digital data value, a green (G) digital data value and a blue (B) digital data value, said hue angle module comprising:

- a module for calculating a luminance value from said input image data, producing a Y digital value;

- a module for calculating intermediate values $x = \text{absolute values of } B - Y$ and $y = \text{absolute value of } R - Y$;

- a module for swapping intermediate values x and y if $y > x$;

- a y-divided-by-x module;

- an action look-up table to provide correction bits for performing calculations within the first subset of hue angle space;

- an arctangent look-up table, said arctangent table producing an intermediate hue angle value.

26. (New) The module for calculating the hue angle of Claim 25 wherein said module for calculating a luminance value performs the calculation $Y = (2 \cdot R + 5 \cdot G + B) / 8$, where Y is substantially the luminance value for said input image data.

27. (New) The module for calculating the hue angle of Claim 25 wherein said module for calculating a luminance value comprises:

- a red left shift-by-one module, said red left shift-by-one module shifting said R digital data value to the left by one digital place value, producing a R intermediate digital data value;

- a green left shift-by-two module, said green left shift-by-two module shifting said G digital data value to the left by two digital place values, producing a G intermediate digital data value;

- a first adder, adding said R intermediate digital data value to said B digital value, producing a first intermediate value;

- a second adder, adding G digital value to said G intermediate digital data value, producing a second intermediate value;

a third adder, adding said first intermediate value to said second intermediate value, producing a third intermediate value; and

a right shift-by-three module, said right shift-by-three module shifting said third intermediate value by three digital place values, producing said luminance value.

28. (New) The module for calculating the hue angle of Claim 25 wherein said action look-up table provides corrections with the first octant of said hue angle space.

29. (New) A module for converting an RGB input image data into an RGBW image data, said module comprising:

a module for calculating the hue angle of said RGB input image data;

a module for selecting the chromaticity triangle of said RGB input image data based upon said hue angle, said chromaticity triangles being selected from one of a group, said group comprising RGW, GBW and BRW;

a module for selecting a multi-primary matrix based upon said chromaticity triangle;

a module for multiplying said multi-primary matrix to said RGB input image data to produce an intermediate RGBW image data value; and

wherein further said multi-primary matrix being selected from one of a group, said group comprising:

168	0	-40	128	0	0	168	-40	0
0	168	-40	-40	168	0	0	128	0
0	0	128 ;	-40	0	168 ;	and	0	-40 168.

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30. (New) The module for converting RGB input image data into an RGBW image data of Claim 29 wherein said group of said multi-primary matrices correspond to RGW, GBW, and BRW chromaticity triangles respectively.

31. (New) The module for converting RGB input image data into an RGBW image data of Claim 29 further comprising:

- a module for detecting out-of-gamut image data values;
- a module for determining the maximum color component that is out-of-gamut;
- an inverse look-up table for providing a scaling factor to apply to said out-of-gamut image values.

32. (New) The module for converting RGB input image data into an RGBW image data of Claim 29 further comprising:

- a module for subpixel rendering said RGBW image data values; and
- an output gamma look-up table for providing gamma values to be applied to image data values from said subpixel rendering module.